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MAP THE DISTRIBUTION OF GLACIOFLUVIAL DEPOSITS AND ASSOCIATED GLACIAL LANDFORMS

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16. Abstract Relatively little good usable ERTS-1 imagery has been received to date for data extraction. Of three U-2 aircraft support missions flown in Maine, only photography from the 20 September flight is cloud free and of excellent quality, received 30 November. Controlled local contract photography flown in August and September is of generally excellent quality. Low altitude "ground truth" photography is useful. The system of image and photo filing is described. Limited work involving image and photo comparison is described. The results, conclusions and recommendations to date are discussed briefly.					
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Preface

(a) Objectives: (1) To utilize very small scale imagery for the detection of glacial landforms by photo interpretation methods, and (2) to compare various imagery types, scales and formats for optimum extraction of data.

(b) Scope: (1) To develop a landform classification system for small scale imagery, (2) compile a surficial geologic map of Maine with emphasis on probable, potential and known glacial deposits of economic importance, and (3) to apply the data to expand the on-going materials inventories within the Bureau of Highways.

(c) Conclusions: Very limited cloud-free ERTS-1 imagery and U-2 support craft imagery received to date indicate that the objectives and scope of the proposal are feasible.

(d) Summary of recommendations: Speed up transmittal of imagery to users.

Introduction

The types, formats and quality of imagery received to date are described, as are the methods of recording and filing. The use, applications and limited work performed pertaining to ERTS-1 and related small scale imagery and photography are discussed, including limitations observed. Ground truth acquisition is described.

Imagery and Photography

1. ERTS-1 satellite imagery received to date is as follows:

- (a) 14 August orbit; two frames, over 60% cloud covered, allowing very little viewing of the land surface.
- (b) 15 August orbit; three frames, conditions about the same as on 14 August.
- (c) 1 September orbit; three frames of virtually cloud-free coverage through the center of the State, allowing the first good look at the land. This imagery was received 3 November. All of the ERTS-1 imagery received consists of 9" black and white paper prints and 70 mm positive transparencies of the four MSS bands, and 70 mm negative transparencies of band 7. Simulated 9" color infrared transparencies and paper prints of the 1 September scenes have been ordered retrospectively, but not yet received.

2. U-2 support aircraft underflights photography to date is as follows:

- (a) 27 April, about 150 linear miles in Maine, flight aborted at Augusta because of over 60% cloud cover. Color infrared 70 mm transparencies were received.

(b) 20 August, 500 linear miles in Maine along a pre-arranged corridor, about 50% cloud cover, four bands of Vinten system 70 mm transparencies.

(c) 20 September, 500 linear miles in Maine along a pre-arranged corridor, three bands of Vinten 70 mm B & W transparencies and RC-10 color infrared 9" transparencies, excellent cloud-free coverage. The RC-10 photography was received 30 November.

3. Local Commercial Photography Underflights - 70 mm vertical stereo coverage of select portions of statewide study areas was obtained by a local photogrammetric concern on charter flights. This photography is at the approximate scales of 1:80,000 and 1:125,000 as follows:

(a) 15 & 16 August, 150 linear miles of color and color infrared 70 mm transparencies, cloud free, within the proposed corridors of the U-2 support mission.

(b) 20 September, 150 linear miles of color infrared only, 70 mm transparencies, using Wratten B, 12 and 15 filters, cloud free, within the U-2 mission corridor, but different coverage than the 15 and 16 August flights. As noted, U-2 coverage was also obtained on this date. ERTS-1 satellite imagery obtained on this date has not been received.

4. Low Altitude Oblique and Near Vertical Photos - Approximately 500 35 mm photographs have been obtained by Mr. Ernest Stoeckeler (Contract No. NAS5-21772) for multidisciplinary uses in this proposal and for his two proposals dealing with hydrology, land use and vegetation damage detection. Eight low altitude flights over select study sites within the U-2 mission corridors of 20 August and 20 September were made. These photographs are color infrared and ektachrome slides and kodacolor and black and white pan-chromatic prints taken at altitudes varying from a few hundred to 10,000 feet, with different sky conditions.

Filing

ERTS imagery, as received, has been filed by observation identification number and image date, with all MSS prints and transparencies for one image stored in one folder. A plot map for each image, made by superimposing the image boundaries on a very small scale map of Maine, is included in each folder. Each base plot map is subdivided into 15-min quadrangle areas for quick identification of particular areas of interest within the ERTS image coverage.

U-2 mission support imagery, as received, was inspected for cloud coverage and ultimate usability. The 27 April mission, having quite dense cloud cover, and being therefore of limited value, was labeled and is stored in the original shipping canister. The 20 August coverage was plotted on 1:250,000 U.S.G.S. maps of the Eastern United States series. Each leg of the mission, i.e. "O-P", "P-Q", etc., was separated into strips of three or four frames, inserted into protective transparent sleeves and filed, with the appropriate plot map, in individual folders. The 20 September coverage is currently being filed in the same manner.

Local commercial underflight coverage is filed using a system similar to that described for U-2 mission photography. Dual coverage obtained for each flight line on 15 and 16 August was by simultaneous exposure of two Hasselblad cameras, one having aerochrome color infrared film and one having Ektachrome color. Both film types for each flight line are filed in one folder.

Low altitude near vertical and oblique photos are filed principally according to their format, and cross-referenced to ERTS, U-2 and contract coverage according to geographical location. Slides are filed systematically in commercial vinyl holders, 20 per page, with numbers and annotations referenced to indexed note pages. Prints are numbered, and similarly indexed for ready reference.

Work Performed

All of the imagery and photography described has been inspected and reviewed. ERTS and U-2 coverage having minimum cloud coverage has been selected for detailed study and comparison with larger scale photography and imagery generated by this proposal. Very large scale photography (1" = 500', 1000' and 1667') in the files of the Materials and Research Division, where it coincides with the small scale ERTS, U-2 and contract imagery, is being used to develop pattern recognition from discernible detail. It should be noted that the three ERTS scenes of 1 September, received 3 November, is the first imagery received that affords a good look at the land surface and thus allows an "in-depth" study to commence.

Glacial features such as eskers, outwash plains, deltas and kame fields previously known and recognized in specific geographic and geomorphic areas are being identified on ERTS imagery. Comparisons of landform imagery on ERTS scenes through progressively larger scale coverage of the same terrain are being made. The Zeiss "Zoom 95" stereoscope is being utilized for comparison viewing of small features, and progressively smaller landform recognition is being achieved, as is recognition of larger features in previously unknown regions. Study will continue as quality of imagery received and time permits. Since the writer is primarily oriented to stereoscopic viewing of geomorphic features, a new concept of tone and hue pattern recognition is being developed for monocular viewing of ERTS imagery. It was initially hoped that successive orbital passes of the ERTS satellite would eventually produce scene overlap to allow stereoscopic viewing of portions of the state.

Ground Truth

A considerable amount of data relative to glacial deposits is contained in the files of the Materials and Research Division, compiled over the past

twenty years from airphoto interpretation, detailed field work and laboratory analyses. This information, in standard materials report form for highway projects, is a wealth of ground truth available for further developing the objectives of this study.

Various measurements, vegetation and soil observations and site comparisons on the ground at specified pin-pointed locations were made by the writer and by four field geologists during, or within a day of, the 15 and 16 August contract flights. Similar ground data were also obtained during the 27 April U-2 mission. These data are being analyzed concurrent with the imagery study. It is expected that applicable data gleaned from routine on-going work performed for the compilation of highway project soils reports will also contribute to ground truth knowledge in executing this study.

Ground truth data are construed to also include the previously mentioned low altitude photography obtained, in many instances, almost concurrently with high altitude contract flights and U-2 missions.

Program for Next Reporting Interval

Continue the study of ERTS imagery, developing recognition techniques and a classification system, insofar as the quality of imagery received allows suitable viewing of the land surface. Simulated color infrared renditions of select scenes, now on order, will be analysed and evaluated. Some color enhancement and microdensitometer analyses will be conducted as time and instrument availability allows. A surficial geologic map incorporating land-form classifications will be developed for areas within the state suitably imaged by the Earth Resources Technology Satellite. Knowledge thus gained will be applied to highway materials studies.

Conclusions

The very limited cloud-free ERTS-1 imagery and U-2 support craft photography received to date seems to indicate that the viewing, comparison and interpretation of large geomorphic areas from very small scale images for generalized surficial mapping is practical. Finite detail from small images is extracted with difficulty at best, however, and maps developed therefrom will have limitations that should be made explicit to users. The lack of stereoscopic overlap in viewing the imagery is a psychological drawback to an interpreter accustomed to using the three dimensional effect in delineating landforms. A benefit probably results to the interpreter, however, in developing a technique that depends more on hue, tone and image location, thus allowing him a wider scope of ability in dealing with various types of imagery.

Cloud-shrouded images and photos, with the resulting ground shadows, are not entirely unusable, but are a decided hindrance in the viewing of large land areas. Continuity of terrain image is an important consideration in most ERTS studies.

Recommendations

Studies would be expedited if there were less delay between the time of good image acquisition and its receipt by investigators.